

Zero Emission Vehicles and Clean Air

Cleaner air needed

California has made tremendous air-quality gains over the past 30 years. In the 1970s, it was common to have 100 or more Stage 1 smog alerts each year in the Los Angeles area. Major efforts to reduce air pollution, mainly by cutting emissions for an automobile by up to 98 percent, have brought markedly cleaner air. From 1995 through 1999, Stage 1 smog alerts in Los Angeles never exceeded 14 in a year, with no Stage 1 alerts recorded in 1999. Still, California faces much more work to reduce air pollution:

- More than 95% of Californians live in areas that do not meet health-based federal or state air quality standards.
- Approximately 50% of smog-forming pollutants come from gasoline and diesel-powered vehicles.
- Although many automobiles sold in California today are 98% cleaner than those sold 30 years ago, population growth and increased driving may soon outpace our ability to improve air quality if we rely solely on continued improvements to gasoline and diesel-powered vehicles.

The California Air Resources Board (ARB) determined in 1990 that further reductions in air pollutants from cars, trucks and other “mobile” sources were necessary if improvement to air quality was to continue—bringing the state more healthful air and meeting federal air quality mandates.

The ZEV mandate

Encouraged by advances in battery electric vehicle technology, the ARB in 1990 acted to stimulate development of zero emission vehicles (ZEVs): cars, trucks and buses that produce no tailpipe or evaporative emissions. The Board adopted a requirement that 10% of the new cars offered for sale in California in 2003 (and beyond) would have to be ZEVs. In February 2000, the Board adopted a similar regulation for transit buses, requiring certain transit agencies to demonstrate zero-emission buses (ZEBs) in 2003 and to begin purchasing 15% ZEBs for their fleets in 2008.

The benefits of the ZEV automobile regulation are now apparent: The major automakers have already put more than 2000 battery-powered ZEVs onto California’s roads. The regulation also spurred other technological advances that include vastly improved alternative fueled vehicles, super-clean vehicles known as super ultra low emission vehicles or “SULEVS” (generally fueled by gasoline or compressed natural gas), fuel-efficient hybrids that are powered by a combination of electric motors and internal combustion engines, and fuel cell vehicles that create their own electricity and can be powered by pollution-free hydrogen.

All of the technological advances fostered by the ZEV regulation may ultimately find a niche in California’s continuing battle against air pollution. But the ARB feels that pure zero emission vehicles must remain in the forefront of the innovative technologies used to bring cleaner air.

Why are ZEVs the “gold standard” for air quality?

ZEVs are superior for clean air over other vehicles in several ways: ZEVs have no tailpipe exhaust, no evaporative emissions from fuel systems, and no emissions from the refining of fuel and distribution of fuel to service stations—all of which are sources of smog-forming air emissions. Furthermore, ZEVs, unlike other vehicles, have no emission control systems that can degrade or fail with time. This is why ZEVs are considered the “gold standard” of future automobile technology.

Other ways ZEVs help

- Aside from reducing smog-forming emissions, increased use of ZEVs will reduce emissions of carbon dioxide, a greenhouse gas that contributes to global warming.
- ZEVs lessen our cancer risk from exposure to toxic air contaminants such as benzene.
- The use of ZEVs and other alternative-fueled vehicles diversifies our energy needs and reduces our dependence on imported oil.

Do ZEVs simply shift air emissions from one place to another?

California’s strict air quality regulations mean our electric power plants are among the cleanest in the world. Much of the electricity generated in California comes from natural gas, hydropower, or nuclear power. Even taking power plant emissions into account, ZEVs are more than 90% cleaner than the cleanest conventional gasoline-powered vehicle. Moreover, emissions from a relatively few power plants are easier to control than emissions generated by millions of cars on the road. Future power plants will be more efficient and even cleaner, and may employ renewable energy sources such as wind and solar energy to further reduce emissions from electricity generation.

What is the current ZEV mandate?

In 1998, the ARB modified the 2003 10% ZEV requirement. The modification allows the major automakers (35,000 or more passenger cars and light-duty trucks sold annually in California) to satisfy up to 6% of their ZEV requirement with automobiles that, while not pure zero emission vehicles, are clean enough to qualify for partial ZEV credits. The other 4% must still be pure ZEVs. Intermediate manufacturers (those selling 4,501 to 35,000 passenger cars and light-duty trucks in California) can meet their entire ZEV requirement with partial ZEV credits. Manufacturers selling fewer than 4,500 vehicles do not have a ZEV requirement. Currently, the only vehicles on the market that qualify as pure ZEVs are those powered by batteries. Qualifying for partial-ZEV credits are certain gasoline-powered vehicles rated by the ARB as SULEVs. These SULEVs have extremely low tailpipe emissions and, to qualify for partial ZEV credits, must also have no evaporative emissions and have warranties of 150,000 miles for air pollution control equipment.

Another vehicle with the potential to meet the SULEV standard and earn partial-ZEV credits in the future is the hybrid-electric. These hybrids combine internal combustion engines with electric motors and rechargeable batteries—using a computer to deliver the most efficient power mix. In addition, vehicles powered by electricity from another source, the fuel cell, are being tested. When fueled by hydrogen, a fuel cell vehicle yields electricity, heat, and water vapor but no harmful air emissions.

Looking ahead to 2003

Sales data on passenger cars, pickup trucks, minivans, and sport utility vehicles sold in California in the 1998 model year provides an estimate of automakers' 2003 ZEV requirements. In the chart below, the 4% figure assumes the automaker will meet 6% of the ZEV requirement through sales of vehicles that earn partial ZEV credits (as most manufacturers are expected to do); the 10% figure would apply if the entire ZEV requirement is met through sales of pure ZEVs. These estimates also assume that in 2003 automakers will sell the same ZEVs that they produce today. Please note that manufacturers have earned, and can continue to earn, extra credits for early introduction of ZEVs or ZEVs with extended range. These credits reduce the number of ZEVs automakers must market in 2003.

Manufacturer	Pure ZEVs produced (as of March, 2000)	2003 model year	
		ZEVs req'd at 4%	ZEVs req'd at 10%
Daimler Chrysler	117	4,228	10,569
Ford	379	7,479	18,698
General Motors	789	4,219	10,547
Honda	276	2,586	6,466
Nissan	81	1,276	3,189
Toyota	486	2,565	6,414

ZEVs produced by major auto manufacturers and others

Manufacturers have produced electric vehicles in a variety of styles including passenger cars, minivans, sport utility vehicles, pickup trucks, motorcycles, and scooters. Batteries used include lead acid, nickel-metal-hydride and, most recently, lithium-ion.

Make/Model	Battery	Range (city/hwy) *
Chrysler EPIC van	Lead Acid	70 / 65
Chrysler EPIC van	Nickel Metal Hydride	92 / 97
Ford Ranger pick-up	Lead Acid	84 / 69
Ford Ranger pick-up	Nickel Metal Hydride	94 / 86
General Motors EV-1	Lead Acid	75 / 78
General Motors EV-1	Nickel Metal Hydride	143 / 152
General Motors EV-1	Advanced Lead Acid	111 / 113
General Motors S-10 pick-up	Lead Acid	46 / 43
General Motors S-10 pick-up	Nickel Metal Hydride	92 / 99
Honda EV-Plus	Nickel Metal Hydride	125 / 105
Nissan Altra EV	Lithium-ion	120 / 107
Toyota RAV-4 EV	Nickel Metal Hydride	142 / 116
Solectria FORCE	Lead Acid	58 / 50
Bombardier Spote-e**	Lead Acid	15 at 25 mph (top speed)
Bombardier Class-e**	Lead Acid	15 at 25 mph (top speed)
GEM*	Lead Acid	25 at 25 mph (top speed)

* Based on standardized tests.

** Street-legal low-speed vehicles.

For More Information

Please contact the ARB toll-free at (800) END-SMOG/(800) 363-7664 (California only) or (800) 242-4450. More information on the Zero Emission Vehicle Program is available on ARB's web site at <http://www.arb.ca.gov/msprog/zevprog/zevprog.htm>.

You may obtain this document in an alternative format by contacting ARB's ADA Coordinator at (916) 322-4505 (voice); (916) 324-9531 (TDD, Sacramento area only); or (800) 700-8326 (TDD, outside Sacramento).